of civilization at which the builders of the *pfahlbauten* had arrived. Long after came the ages of bronze and iron, and finally the Roman period, with its fixed dates and absolute chronology. A rapid review of the history of humanity in Europe shows us an uninterrupted series of events, looking back from the Roman period, through the various lacustrine epochs as far as the most ancient remains of polished stone. But there occurs a gap. We are not in presence of fixed dates, and the continuity of the events alone gives us a perfect key to their relative antiquity. Professor Forel asks — has this lacuna lasted a hundred years, a hundred thousand, or millions of years? And, while he does not attempt to precisely estimate its duration, he proves convincingly that the gap is considerable, but that it is not enormously large. The age of trees which must have grown in the rich vegetable beds of Morges, after mould had been slowly formed from the débris of the pebble beds of the glacial period, indicates a vast lapse of time. Professor Forel enters at great length into certain results at which he has arrived after sounding the Rhône at various levels, and precisely estimating the amounts of mud which the river annually transports. He considers that a space of 300,000 years is necessary in order to fill the lake of Geneva, and that in time the lake will be entirely filled up. His conclusions, in fact, are that the space of time which separates the archæological ages of the reindeer and of the red deer (palæolithic and neolithic epochs) is considerable, and ought to be counted by thousands of years; it is not infinitely great, and ought not to be counted by millions of years.

MICROSCOPY.

"Power" of Lenses.—For some three or four years some American microscopists have been calling attention to the "deception" commonly practised by most working opticians in calling the "power of their instrument less than it really is — *i. e.*, calling an objective a quarter-inch when its focus is really but one-fifth or one-sixth of an inch — or an eighth when actually a "one-ninth or one-tenth,— and some now approach to one-twelfth."

In the "Monthly Microscopical Journal" for December, 1871, Mr. F. H. Wenham writes a paper in reply to one of Mr. E. Bicknell's on this subject in which he takes Mr. Bicknell to task for exposing the deception,— and admits the truth of the charge.

Here we have a gentleman, well known throughout the microscopical world as one of the most accomplished *theoretic opticians* of London, generally supposed to be the principal advisor of the working opticians, not apologizing for, but practically defending the imposition, one that has been exposed and complained of by Dr. Wm. B. Carpenter * and also by a writer in the "Quarterly Journal of Microscopical Science."

Mr. Wenham says "a scientific microscopist gives the diameters with his illustrations and the nominal power of his object glass; this quite meets the case." In this Mr. Wenham is entirely wrong; it does not meet the case. A power of one-thousand diameters obtained with a one-inch objective is a very different thing from one-thousand diameters obtained with a one-tenth, *unless the one-inch is ten times as good an instrument as the one-tenth.* The scientific microscopist should give with his illustrations, not only the amplification he employed, but the real focus of the objective, and the name of the maker, as astronomers do in the case of their telescopic observations.

He farther says, "in such a difficult and complex arrangement as a high power object-glass, it is almost impossible for all the makers to work to the same magnifying standard." That of course depends on the knowledge of optics possessed by the workman, but has nothing to do with the matter. When the object-glass *is made*, the focus can be measured, and the glass named accordingly. The nearer the actual power comes to that intended, so much the more credit to the maker — the farther it is from what he sells it for the more to his discredit. It is an axiom in microscopy that the lower the power of a glass that will give a certain result or effect, the better the glass.

Mr. Wenham's comparison with the steam engine is as inappropriate as Hartnack's objection to English microscopes, that with their wheels and screws they look like a steam engine.—C. S.

PHOTOGRAPHIC MICROMETER AND GONIOMETER.—J. C. Southworth, of Georgetown, D. C., proposes, in the "American Journal of Science and Arts," a photographic positive on glass as a substitute for the ruled micrometers. Lines of one-sixth inch interval are reduced by photography to $\frac{1}{200}$ inch, mounted in balsam, and used like the ordinary eye-piece micrometers. The lines are black

*The Microscope, etc. London. 1868. p. 184.

and distinct and the intervening spaces are said to be sufficiently translucent, which would suggest that the contrivance is best suited for the rapid and easy performance of easy work.

Similarly a goniometer is made by reducing a graduated circle of eighteen inches to a transparent positive of suitable size to be placed in the draw-tube below a positive eye-piece. The eye-piece is furnished with a cob-web line, and its rotation is easily read off on the scale in its focus. This goniometer, which could be made for a few shillings, would seem to be a valuable accessory to all microscopes, especially to those not possessed of a graduated concentric stage.

THE DIATOM HOAX.—Many readers have enjoyed, in a late medical journal, the ingenious essay on test-objects, in which the new immersion one-seventieth of 191°, wet with fluoric acid and illuminated by a new eccentric parallelopiped with fluorescent rays exclusively, is represented as revealing that the structure of *Pleurosigma angulatum* is like the Nicholson pavement; and that a new diatom, fortunately rare, has beads, more than one hundred and forty-seven millions to the inch, which are invisible by all other lenses and to all other observers. They will be further amused by learning from the "Boston Journal of Chemistry" that some foreign medical journals have seriously reviewed this burlesque and discovered it to be a hoax.

THE RED BLOOD-CORPUSCLE.—Mr. E. Ray Lankester presents in the "Quarterly Journal of Microscopical Science" an interesting contribution to our knowledge of the physical structure of the red blood-corpuscle and the action of gases and vapors upon it.

The red blood-corpuscle has no outer coat distinct from its contents and having a pronounced inner limitation, none being visible under the highest powers of the microscope (what might be mistaken under low powers for such proving under high powers to be an illusion of refraction), and the corpuscles, torn or cut by drawing a needle across the slide, suffering no escape of viscid material from their interior, but furnishing portions which by the collapse of their edges assume a rounded form; yet their surface must be differentiated into a film or pellicle having no definite inner boundary, and similar to the pellicle which forms on a cooling mass of jelly, since they become wrinkled when subjected to oblique pressure and recover their form and outline again with great elasticity and precision.

The stroma of which the viscid mass mainly consists appears homogeneous in the mammalia, but contains a nucleus in the other vertebrata. This nucleus, though undetected by Savory, seems to exist in perfectly fresh corpuscles, and has been detected in blood while circulating in the vessels of the frog. It is somewhat indistinct, though a temporary delimitation may be caused by certain physiological conditions of the animal, and after removal from the circulation it becomes sharply and permanently defined.

The usually described forms characteristic of certain classes of animals, are not believed to be the only normal forms. The blood of the frog seems to vary at different seasons of the year, and the ordinary biconcave discs of human blood may be more or less replaced, in fresh and perfectly healthy blood, by the "thorn-apple" and the "single" and "double watch-glass forms."

The macula discovered by Dr. Roberts of Manchester in the blood of all vertebrata are strangely ignored by most of the recent authorities, though published many years ago. They are fully verified by the author's researches. A part of the matter composing the corpuscle segregates to form spots, usually one in man but often three or four in the frog, which are ordinarily imperceptible, but which are deeply stained by nitrate of rosanilin, and form sharp little pullulations under the influence of tannin. Whether the development of these macula is *post-mortem* or not seems to be undetermined.

That the corpuscles are not in the condition simply of a moistened membrane is shown by the very curious observation that they will readily float out of the plasma into a drop of oil. When separated in this manner from the plasma they show a strong tendency to cohere and thus assume hexagonal forms, just as they sometimes do when a thin film of blood is dried upon a slide.

The appearance and disappearance of the granulation of the nucleus and other effects demonstrated by Stricker to take place when blood, after contact with aqueous vapor, is exposed alternately to carbonic acid and atmospheric air, is proved to be due to the alternate presence and absence of the carbonic acid, and not in any part to the oxygen of the atmosphere, since the air may be replaced in the experiment by hydrogen or other gases.

The action of chloroform and many other re-agents upon the corpuscles is studied minutely, but without as yet throwing the desired light upon their effects when introduced into the living system.

The preservation of blood absolutely unchanged in appearance is essential to a successful study of its structure. Hitherto the inadequacy of most students' microscopes and the necessity for immediate and hasty inspection of blood has almost prevented its successful study. To these reasons it should be added that only the few students who make somewhat of a specialty of this branch of science can become sufficiently expert for its more difficult investigations; and the author's estimate of drying as a means of preserving blood, that it is of little or no use, meets with an important exception in the case of studies as to the class of animals to which a given specimen of blood belongs, and also in the determination of the existence of certain diseases. For all purposes, however, it is desirable to preserve the corpuscles in their natural state, and osmic acid has been successfully introduced for this purpose by Prof. Max Schultz. A film of blood on a glass cover is exposed for three minutes to the vapor arising from a bottle of two per cent. solution of osmic acid; after which it may be immediately mounted in a nearly saturated solution of acetate of potash. "Every corpuscle thus becomes 'set,' as it were, in its living form."

A New Group of Infusoria. — In studying the blood of frogs Mr. E. Ray Lankester has sometimes noticed a little parasite which was at first mistaken for a very active white blood-corpuscle. This new infusorian, which is figured in the "Quarterly Journal of Microscopical Science" for October last under the name of *Undulina ranarum*, is a minute pyriform sac, the narrower end of which is somewhat twisted and spirally bent round upon itself, giving it a strikingly shell-like appearance. It has neither mouth nor cilia, but instead of the latter a broad, toothed, undulating membrane which makes it the type of a new group of infusoria.

Structure of Minute Organisms. — The "New York Evangelist," in describing with very natural admiration the beautiful Moller's Type Plate (the *diatoms* of which, by the way, are undoubtedly vegetable and not animal organisms), raises again the question whether these minute organisms may not be possessed of organs and tastes corresponding to those of higher aminals. Persons having an intelligent interest in the science of microscopy, but unfamiliar with its details, cannot be too well assured that the extreme simplicity of the lower organisms is a fact of positive,

not of negative, knowledge, — a conclusion reached from what we see, and not from what we fail to see.

PURE WATER. — Dr. Burdon Sanderson, F.R.S., found it impossible to obtain optically pure water. The fusion of ice furnished the nearest approach to this standard.

RAILWAY DUST. — The "Manchester Guardian" publishes a study of railway dust made by Mr. J. Sidebotham, who finds it to consist, in the case examined, about one-half of particles of iron, and the other half of cinders, sand, etc. Some of the particles of iron were magnetic, and most were sharp, rough and irritating.

NOTES.

WE make the following extracts from a letter to one of the editors from Mr. Dall, Chief of the Coast Survey Expedition to explore the hydrography and natural history of Alaska. It is dated Harbor of Iliuliuk, Unalashka, Alaska Terr., Oct. 30, 1871 :

"We arrived here on the 23d of September after a disagreeable passage of twenty-six days from San Francisco, during which, however, we obtained some very interesting observations on the currents. We have been very busy since we arrived, and have accumulated abundance of material to keep us busy all winter, both in regard to Natural History and Hydrography. This harbor is a fine one, and we have a chart well under way and hope by spring to have it approximately complete. Tidal and current observations are going on, we have taken many hundreds of angles and shall go to sounding bye and bye.

The island when we came was a mass of verdure up to the snow caps of the highest peaks. There are no trees, except half a dozen planted by Veniaminoff, the apostle of the Aleuts, in 1805. They are Sitka spruce, very stout and thick, but only about fifteen feet high. The indigenous shrubs and willows are seldom more than six feet high and an inch or two thick. I went on an exploring trip the other day in the interior of the island and with the exception of some wood which we packed on our backs for kindling, we had to boil our tea with green huckleberry bushes! But the herbage is very rich and rank. Sheep and pigs do exceedingly well here with less care than they need at home and I believe hardy cattle would do the same. The winter is wet and windy, but not cold; there is a good deal of snow but it melts very quickly after it falls and rarely lies on the ground any length of time except in severe seasons. The waters abound with fish but there are no land animals, except spermophiles and foxes. Whales are very